

CLAIMS

What is claimed is:

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1. A method of fabricating a semiconductor device to be assembled in a face-down orientation on a test substrate, comprising:
providing at least one of a semiconductor device having contact pads and a test substrate having test pads; and
disposing at least one stabilizer on a surface at least one of said semiconductor device and said test substrate in a location sufficient to at least partially stabilize an orientation of said semiconductor device upon assembly with said test substrate.
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2. The method of claim 1, wherein said disposing said at least one stabilizer comprises disposing a plurality of stabilizers on said surface.
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3. The method of claim 2, wherein said disposing said plurality of stabilizers comprises disposing at least one stabilizer of said plurality of stabilizers adjacent at least one corner of said surface.
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4. The method of claim 2, wherein said disposing said plurality of stabilizers comprises disposing a first stabilizer of said plurality adjacent a first edge of said surface and disposing a second stabilizer of said plurality adjacent a second, opposite edge of said surface.
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5. The method of claim 2, wherein said disposing said plurality of stabilizers comprises disposing a plurality of stabilizers on said surface to protrude a substantially uniform distance from said surface.
6. The method of claim 1, wherein said disposing said at least one stabilizer comprises fabricating said at least one stabilizer on said surface.

7. The method of claim 6, wherein said fabricating comprises fabricating said at least one stabilizer from a photopolymer.

8. The method of claim 7, wherein said fabricating comprises fabricating at least two superimposed, contiguous, mutually adhered layers.

9. The method of claim 1, wherein said providing comprises providing at least one semiconductor die

10. The method of claim 1, wherein said providing comprises providing a semiconductor wafer with a plurality of semiconductor dice.

11. The method of claim 1, wherein said providing comprises providing a chip-scale package.

12. The method of claim 1, wherein said providing comprises providing both said semiconductor device and said test substrate and wherein said disposing comprising disposing at least one stabilizer on a surface of each of said semiconductor device and said test substrate.

13. The method of claim 1, wherein said disposing comprises adhering said at least one pre-formed stabilizer to said surface.

14. The method of claim 1, further comprising, prior to said disposing, fabricating said at least one stabilizer from a photopolymer material.

15. The method of claim 14, wherein said fabricating comprises fabricating at least two superimposed, contiguous, mutually adhered layers.

16. The method of claim 1, wherein said disposing said at least one stabilizer comprises applying a layer of insulative material on said surface and selectively patterning said layer.

5 17. The method of claim 1, wherein said disposing said at least one stabilizer comprises applying a layer of photoresist material on said surface and selectively patterning said layer.

10 18. The method of claim 1, further comprising disposing at least one conductive structure in contact with at least one of said contact pads of said semiconductor device and said test pads of said test substrate.

15 19. The method of claim 18, wherein said disposing at least one conductive structure comprises forming at least one solder bump on at least one of said contact pads of said semiconductor device and said test pads of said test substrate.

20 20. The method of claim 18, wherein said disposing at least one conductive structure comprises applying at least one structure comprising a solder, a metal, a metal alloy, a conductor filled epoxy, a conductive epoxy, or a z-axis conductive elastomer to at least one of said contact pads of said semiconductor device and said test pads of said test substrate.

25 21. The method of claim 18, further comprising selecting said at least one stabilizer to protrude from said surface at most a distance that said at least one conductive structure protrudes from said surface.

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10 22. A method of fabricating a semiconductor device component, comprising:
providing at least one of a semiconductor device with contact pads exposed at a surface
thereof and a test substrate with test pads exposed at a surface thereof; and
sequentially forming layers of at least one stabilizer on a surface of said at least one of
said semiconductor device and said test substrate, said at least one stabilizer
protruding from said surface and having a plurality of superimposed, contiguous,
mutually adhered layers, each of said layers comprising a photopolymer, said
stabilizer being located on said surface so as to at least partially stabilize an
orientation of said semiconductor device upon disposal thereof face-down on said
test substrate.

15 23. A method of fabricating a semiconductor device component, comprising:
placing at least one of a semiconductor device with contact pads and a test substrate with
test pads in a horizontal plane;
recognizing a location and orientation of said at least one of said semiconductor device
and said test substrate;
stereolithographically fabricating at least one stabilizer comprising at least one layer of
semi-solid material on a surface of said at least one of said semiconductor device
and said test substrate, said at least one stabilizer being configured to at least
20 partially stabilize an orientation of said semiconductor device upon disposal
thereof face-down on said test substrate.

25 24. The method of claim 23, further comprising storing data including at least
one physical parameter of said at least one of said semiconductor device and said test
substrate and of said at least one stabilizer in computer memory, and using the stored data
in conjunction with a machine vision system to recognize the location and orientation of
said at least one of said semiconductor device and said test substrate.

25. The method of claim 24, further including in computer memory at least one parameter of another semiconductor device component with which each said at least one of said semiconductor device and said test substrate is to be assembled.

5 26. The method of claim 24, further comprising using the stored data, in conjunction with said machine vision system, to selectively apply said at least one layer of semi-solid material stereolithographically to at least one portion of said surface.

10 27. The method of claim 24, further including securing said at least one substrate to a carrier prior to placing said at least one substrate in said horizontal plane.

15 28. The method of claim 24, further comprising recognizing a location of at least one of said contact pads of said semiconductor device and said test pads of said test substrate.

20 29. A method of assembling a semiconductor device with a test substrate, comprising:
providing a semiconductor device having contact pads exposed at a surface thereof;
selecting a test substrate having test pads on a surface thereof, said test pads being located correspondingly to at least selected ones of said contact pads;
securing at least one stabilizer to a surface of at least one of said semiconductor device and said test substrate; and
25 disposing said semiconductor device face-down on said substrate with said at least selected ones of said contact pads in communication with corresponding ones of said test pads.

30 30. The method of claim 29, further comprising disposing conductive structures between said at least selected ones of said contact pads and said corresponding ones of said test pads.

31. The method of claim 29, wherein said securing comprises securing said at least one stabilizer to a surface of at least one of said semiconductor device and said test substrate to face another surface of the other of said semiconductor device and said test substrate upon said disposing.

32. The method of claim 29, wherein said securing comprises securing at least one stabilizer to each of said semiconductor device and said test substrate.

33. The method of claim 29, wherein said securing comprises securing at least one pre-fabricated stabilizer to said surface.

34. The method of claim 33, further comprising stereolithographically fabricating said at least one pre-fabricated stabilizer.

35. The method of claim 33, wherein said securing comprises adhering said at least one pre-fabricated stabilizer to said surface.

36. The method of claim 29, wherein said securing comprises fabricating said at least one stabilizer on said surface.

37. The method of claim 29, further comprising positioning said at least one stabilizer on said surface so as to at least partially stabilize said semiconductor device upon said disposing.

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38. A semiconductor device, comprising:
a substrate having contact pads exposed at a surface thereof, said contact pads being
configured to communicate with corresponding test pads of a test substrate upon
disposing said substrate face-down over said test substrate; and
at least one stabilizer protruding from said surface, said at least one stabilizer being
configured to at least partially stabilize an orientation of the semiconductor device
upon disposal face-down over said test substrate.

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39. The semiconductor device of claim 38, wherein said at least one stabilizer
protrudes from said surface at most a distance between a plane of said surface of said
substrate and a plane of a surface of said test substrate upon disposing said substrate
face-down over said test substrate.

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40. The semiconductor device of claim 39, wherein said at least one stabilizer
protrudes from said surface at most distance between said plane of said surface of said
substrate and said plane of said surface of said test substrate when at least one conductor
connects at least one of said contact pads and a corresponding one of said test pads.

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41. The semiconductor device of claim 38, wherein said at least one stabilizer
comprises a dielectric material.

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42. The semiconductor device of claim 38, wherein said stabilizer comprises a
photopolymer.

43. The semiconductor device of claim 42, wherein said photopolymer is at
least semisolid.

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44. The semiconductor device of claim 42, wherein said at least one stabilizer
has a plurality of superimposed, contiguous, mutually adhered layers.

45. The semiconductor device of claim 38, wherein said at least one stabilizer is positioned to be located proximate a corner of said surface.

46. The semiconductor device of claim 38, wherein said at least one stabilizer is positioned to be located proximate an edge of said surface.

47. The semiconductor device of claim 38, wherein said at least one stabilizer has a cross-sectional plan of one of quadrilateral, round, oval, and triangular.

48. The semiconductor device of claim 38, wherein said at least one stabilizer is elongated.

49. The semiconductor device of claim 38, wherein said substrate comprises a semiconductor wafer.

50. The semiconductor device of claim 38, wherein said substrate comprises a semiconductor die.

51. The semiconductor device of claim 38, wherein said substrate comprises a chip-scale package.

52. The semiconductor device of claim 38, wherein said test substrate also includes at least one stabilizer configured to at least partially stabilize said substrate upon disposing said substrate face-down over said test substrate.

53. A test substrate, comprising:
a substrate having test pads exposed at a surface thereof, said test pads being configured to communicate with corresponding contact pads of a semiconductor device to be disposed face-down over said substrate; and

at least one stabilizer protruding from said surface, said at least one stabilizer being configured to at least partially stabilize the semiconductor device upon disposal face-down over test substrate.

5 54. The test substrate of claim 53, wherein said at least one stabilizer protrudes from said surface at most a distance between a plane of said surface of said substrate and a plane of a surface of said semiconductor device upon disposing said semiconductor device face-down over said substrate.

10 55. The test substrate of claim 54, wherein said at least one stabilizer protrudes from said surface at most distance between said plane of said surface of said substrate and said plane of said surface of said semiconductor device when at least one conductor connects at least one of said contact pads and a corresponding one of said test pads.

15 56. The test substrate of claim 53, wherein said at least one stabilizer comprises a photopolymer.

20 57. The test substrate of claim 56, wherein said photopolymer is at least semisolid.

58. The test substrate of claim 56, wherein said at least one stabilizer comprises a plurality of superimposed, contiguous, mutually adhered layers.

25 59. The test substrate of claim 53, wherein said semiconductor device has at least one stabilizer secured to a surface thereof, said at least one stabilizer configured to at least partially stabilize said semiconductor device upon disposal of said semiconductor device face-down over said substrate.

30 60. An assembly of a semiconductor device and a test substrate, comprising:

a test substrate with at least one test pad exposed at a surface thereof;
a semiconductor device with at least one contact pad exposed at a surface thereof, said
surface of said semiconductor device facing said surface of said test substrate with
said at least one contact pad in communication with said at least one test pad; and
at least one stabilizer disposed between said test substrate and said semiconductor device.

61. The assembly of claim 60, wherein said at least one stabilizer is secured to
said surface of said test substrate.

62. The assembly of claim 60, wherein said at least one stabilizer is secured to
said surface of said semiconductor device.

63. The assembly of claim 60, comprising a plurality of stabilizers, at least
one of said plurality of stabilizers being secured to said surface of said test substrate and
at least one other of said plurality of stabilizers being secured to said surface of said
semiconductor device.

64. The assembly of claim 60, wherein said at least one stabilizer comprises a
photopolymer.

65. The assembly of claim 60, wherein said photopolymer is at least
semisolid.

66. The assembly of claim 64, wherein said at least one stabilizer has a
plurality of superimposed, contiguous, mutually adhered layers.

67. The assembly of claim 60, wherein said at least one stabilizer extends
between a plane of said surface of said test substrate and a plane of said surface of said
semiconductor device at most a distance between said planes of said surfaces upon

establishing communication between said at least one test pad and said at least one contact pad.

5 68. The assembly of claim 60, further comprising at least one conductive structure disposed between said test substrate and said semiconductor device.

10 69. The assembly of claim 60, wherein said at least one stabilizer extends between a plane of said surface of said test substrate and a plane of said surface of said semiconductor device at most a distance said at least one conductive structure extends between said planes of said surfaces.

15 70. A method for stabilizing a semiconductor device disposed face-down over a test substrate, comprising:
securing at least one stabilizer configured to at least partially stabilize the semiconductor device to a surface of at least one of the semiconductor device and the test substrate; and
20 inverting and positioning the semiconductor device over the test substrate so as to establish communication between at least one contact pad of the semiconductor device and a corresponding test pads of the test substrate.

25 71. The method of claim 70, wherein said securing comprises stereolithographically fabricating said at least one stabilizer on said surface.

30 72. The method of claim 70, wherein said securing comprises:
forming a first layer of material in an unconsolidated state over at least a portion of said surface; and
selectively altering a state of said first layer in a location to which said at least one stabilizer is to be secured to at least a partially consolidated state to form a first layer of said at least one stabilizer while leaving material in other portions of said layer in said unconsolidated state.

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74. The method of claim 70, further comprising disposing at least one conductive structure in contact with said at least one contact pad and said corresponding test pad.

Socioeconomic status		Age		Gender		Marital status		Education		Occupation		Income		Health status		Social network		Coping strategies		Life satisfaction	
High	Low	Young	Old	Male	Female	Married	Single	High	Low	Professional	Unemployed	High	Low	Good	Poor	Large	Small	Active	Passive	High	Low
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116
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435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456
470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491
505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526
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575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	59		